What is claimed is:

5   1.   Apparatus for processing a multi-channel audio signal,
the multi-channel audio signal having at least three origi-
nal channels, comprising:

       means for providing a first downmix channel and a sec-
10 ond downmix channel, the first and the second downmix chan-
nels being derived from the original channels;

       means for calculating channel side information for a
selected original channel of the original signals, the
15 means for calculating being operative to calculate the
channel side information such that a downmix channel or a
combined downmix channel including the first and the second
downmix channel, when weighted using the channel side in-
formation, results in an approximation of the selected
20 original channel; and

       means for generating output data, the output data in-
cluding the channel side information.

25 2.   Apparatus in accordance with claim 1, in which the
means for generating is operative to generate the output
data such that the output data additionally include the
first downmix channel or a signal derived from the first
downmix channel and the second downmix channel or a signal
30 derived from the second downmix channel.

       3.   Apparatus in accordance with claim 1, in which the
means for calculating is operative to determine the channel

side information as parametric data not including time do-
main samples or spectral values.

4. Apparatus in accordance with claim 1, in which the
means for calculating is operative to perform joint stereo
coding using a downmix channel as a carrier channel and us-
ing, as an input channel, the selected original channel, to
generate joint stereo parameters as channel side informa-
tion for the selected original channel.

5. Apparatus in accordance with claim 3, in which the
means for calculating is operative to perform intensity
stereo coding or binaural cue coding, such that the channel
side information represent an energy distribution or binau-
ral cue parameters for the selected original channel,
wherein a downmix channel or a combined downmix channel is
usable as a carrier channel.

6. Apparatus in accordance with claim 1,

in which the multi-channel audio signal includes a
left channel, a left surround channel, a right channel and
a right surround channel,

in which the means for providing is operative to pro-
vide the first downmix channel as a left downmix channel
and to provide the second downmix channel as a right down-
mix channel, the left and the right downmix channels being
formed such that a result, when played, is a stereo repre-
sentation of the multi-channel audio signal, and

in which the means for calculating is operative

to calculate the channel side information for the left channel as the selected original channel using the left downmix channel,

5   to calculate the channel side information for the right channel as the selected original channel using the right downmix channel,

to calculate the channel side information for the left surround channel as the selected original channel

10   using the left downmix channel, and

to calculate the channel side information for the right surround channel as the selected original chan-

15   nel using the right downmix channel.

7.   Apparatus in accordance with claim 1,

in which the original channels include a center chan-

20   nel,

which further includes a combiner for combining the first downmix channel and the second downmix channel to obtain the combined downmix channel; and

25   wherein the means for calculating the channel side information for the center channel as the selected original channel is operative to calculate the channel side information such that the combined downmix channel when weighted

30   using the channel side information results in an approximation of the original center channel.

8.   Apparatus in accordance with claim 1, in which the
means for providing is operative to derive the first down-
mix channel and the second downmix channel from the origi-
nal channels using a first predetermined linear weighted
5   combination for the first downmix channel and using a sec-
ond predetermined linear weighted combination for the sec-
ond downmix channel.

9.   Apparatus in accordance with claim 7, in which the
10   first predetermined linear weighted combination is defined
as follows:

$$Lc = t \cdot (L + a \cdot Ls + b \cdot C); \text{ or}$$

15   in which the predetermined second linear weighted com-
bination is defined as follows:

$$Rc = t \cdot (R + a \cdot Rs + b \cdot C),$$

20   wherein Lc is the first downmix channel, wherein Rc is
the second downmix channel, wherein t, a and b are weight-
ing factors smaller than 1, wherein L is an original left
channel, wherein C is an original center channel, wherein R
is an original right channel, wherein Ls is an original
25   left surround channel, and wherein Rs is an original right
surround channel.

10.   Apparatus in accordance with claim 1, in which the
means for providing is operative to receive externally sup-
30   plied first and second downmix channels.

11.   Apparatus in accordance with claim 1, in which the
first downmix channel and the second downmix channel are

composite channels being composite of the original channels
in varying degrees, wherein the means for calculating is
operative, to use, for calculating the channel side infor-
mation, the downmix channel among both downmix channels,
5   which is stronger influenced by the selected original chan-
nel when compared to the other downmix channel.

12. Apparatus in accordance with claim 1, in which the
means for generating is operative to form the output data
10   such that the output data are in compliance with an output
data syntax to be used by a low level decoder for process-
ing the first downmix channel or a signal derived from the
first downmix channel or the second downmix channel or a
signal derived from the second downmix channel to obtain a
15   decoded stereo representation of the multi-channel audio
signal.

13. Apparatus in accordance with claim 12, in which the
output data syntax is structured such that same includes a
20   special data field to be ignored by a low level decoder,
and in which the means for generating is operative to in-
sert the channel side information into the special data
field.

25   14. Apparatus in accordance with claim 13, in which the
syntax is mp3 syntax and the special data field is an an-
cillary data field.

15. Apparatus in accordance with claim 12, in which the
30   means for generating is operative to insert the channel
side information into the output data such that the channel
side information are only used by a high level decoder but
are ignored by the low level decoder.

16. Apparatus in accordance with claim 2, which further comprises an encoder for encoding the first downmix channel to obtain the signal derived from the first downmix channel or for encoding the second downmix channel to obtain the signal derived from the second downmix channel.

17. Apparatus in accordance with claim 16, in which the encoder is a perceptual encoder which includes means for converting a signal to be encoded into a spectral representation, means for quantizing the spectral representation using a psychoacoustic model and means for entropy encoding a quantized spectral representation to obtain an entropy encoded quantized spectral representation as the signal derived from the first downmix channel or the signal derived from the second downmix channel.

18. Apparatus in accordance with claim 17, in which the perceptual encoder is an encoder in accordance with MPEG-1/2 layer III (mp3) or MPEG-2/4 advanced audio coding (AAC).

19. Apparatus in accordance with claim 1, in which the means for calculating is operative to calculate downmix energy values for the downmix channel or the combined downmix channel,

to calculate an original energy value for the selected original channel, and

to calculate a gain factor as the channel side information, the gain factor being derived from the downmix energy value and the original energy value.

20. Apparatus in accordance with claim 1, in which the means for calculating is operative to calculate frequency dependent channel side information parameters such that for

5 a plurality of frequency bands, a plurality of different channel side information parameters are obtained.

21. Method of processing a multi-channel audio signal, the multi-channel audio signal having at least three original

10 channels, comprising:

providing a first downmix channel and a second downmix channel, the first and the second downmix channels being derived from the original channels;

15 calculating channel side information for a selected original channel of the original signals such that a down-mix channel or a combined downmix channel including the first and the second downmix channel, when weighted using

20 the channel side information, results in an approximation of the selected original channel; and

generating output data, the output data including the channel side information.

25 22. Apparatus for inverse processing of input data, the input data including channel side information, a first downmix channel or a signal derived from the first downmix channel and a second downmix channel or a signal derived from the second downmix channel, wherein the first downmix

30 channel and the second downmix channel are derived from at least three original channels of a multi-channel audio sig-nal, and wherein the channel side information are calcu-

lated such that a downmix channel or a combined downmix channel including the first downmix channel and the second downmix channel, when weighted using the channel side information, results in an approximation of the selected
5   original channel, the apparatus comprising:

an input data reader for reading the input data to obtain the first downmix channel or a signal derived from the first downmix channel and the second downmix channel or a
10 signal derived from the second downmix channel and the channel side information; and

a channel reconstructor for reconstructing the approximation of the selected original channel using the
15 channel side information and the downmix channel or the combined downmix channel to obtain the approximation of the selected original channel.

23. Apparatus in accordance with claim 22, further com-
20 prising a perceptual decoder for decoding the signal derived from the first downmix channel to obtain the decoded version of the first downmix channel and for decoding the signal derived from the second downmix channel to obtain a decoded version of the second downmix channel.

25
24. Apparatus in accordance with claim 22, further comprising a combiner for combining the first downmix channel and the second downmix channel to obtain the combined downmix channel.

30
25. Apparatus in accordance with claim 22,

in which the original audio signal includes a left
channel, a left surround channel, a right channel, a right
surround channel and center channel,

5   wherein the first downmix channel and the second down-
mix channel are a left downmix channel and a right downmix
channel, respectively, and

wherein the input data include channel side informa-
10   tion for at least three of the left channel, the left sur-
round channel, the right channel, the right surround chan-
nel and the center channel,

wherein the channel reconstructor is operative

15

to reconstruct an approximation of the left chan-
nel using channel side information for the left chan-
nel and the left downmix channel,

20   to reconstruct an approximation for the left sur-
round channel using channel side information for the
left surround channel and the left downmix channel,

to reconstruct an approximation for the right
25   channel using channel side information for the right
channel and the right downmix channel, and

to reconstruct an approximation for the right
surround channel using channel side information for
30   the right surround channel and the right downmix chan-
nel.

26. Apparatus in accordance with claim 22, in which the channel reconstructor is operative to reconstruct an approximation for the center channel using channel side information for the center channel and the combined downmix channel.

27. Method of inverse processing of input data, the input data including channel side information, a first downmix channel or a signal derived from the first downmix channel and a second downmix channel or a signal derived from the second downmix channel, wherein the first downmix channel and the second downmix channel are derived from at least three original channels of a multi-channel audio signal, and wherein the channel side information are calculated such that a downmix channel or a combined downmix channel including the first downmix channel and the second downmix channel, when weighted using the channel side information, results in an approximation of the selected original channel, the method comprising:

reading the input data to obtain the first downmix channel or a signal derived from the first downmix channel and the second downmix channel or a signal derived from the second downmix channel and the channel side information; and

reconstructing the approximation of the selected original channel using the channel side information and the downmix channel or the combined downmix channel to obtain the approximation of the selected original channel.

28. Computer program having a program code for performing a method of processing a multi-channel audio signal, the

multi-channel audio signal having at least three original channels, comprising:

providing a first downmix channel and a second downmix channel, the first and the second downmix channels being derived from the original channels;

calculating channel side information for a selected original channel of the original signals such that a downmix channel or a combined downmix channel including the first and the second downmix channel, when weighted using the channel side information, results in an approximation of the selected original channel; and

generating output data, the output data including the channel side information.

29. Computer program having a program code for performing a method for inverse processing of input data, the input data including channel side information, a first downmix channel or a signal derived from the first downmix channel and a second downmix channel or a signal derived from the second downmix channel, wherein the first downmix channel and the second downmix channel are derived from at least three original channels of a multi-channel audio signal, and wherein the channel side information are calculated such that a downmix channel or a combined downmix channel including the first downmix channel and the second downmix channel, when weighted using the channel side information, results in an approximation of the selected original channel, the method comprising:

reading the input data to obtain the first downmix channel or a signal derived from the first downmix channel and the second downmix channel or a signal derived from the second downmix channel and the channel side information;

5   and

reconstructing the approximation of the selected original channel using the channel side information and the downmix channel or the combined downmix channel to obtain

10   the approximation of the selected original channel.